Factors Associated with Compliance to Solid Waste Segregation among Health Care Workers in Martini Hospital, Somalia

Fathi Burale Mohamed[1], David R. Mutekanga[2], Christopher Ddamulira[3], Paul Katamba[4]
School of Graduate Studies, Bugema University, Uganda

Corresponding author: drmutekanga@bugemauniv.ac.ug

Abstract

Background: While recognizing the challenges of managing waste in health facilities, this study aimed to assess the individual and socioeconomic factors associated with compliance to solid waste segregation among healthcare workers in Martini Hospital, Somalia; and suggested remedies for improved solid waste segregation.

Method: The study used the facility-based cross-sectional survey design with a quantitative approach. The results show that awareness of and attitude toward solid waste segregation among individual factors, and health system orientation among health system factors had a significant relationship with compliance to solid waste segregation.

Result: The study concludes that there is a high burden of poor compliance to solid waste segregation and that if no appropriate interventions are put in place, it could be detrimental to the health of the workers and the community. It also concludes that awareness and attitude towards solid waste segregation and health system orientation is critical in improving compliance to solid waste segregation.

Conclusion: Health workers should comply with solid waste segregation and that health facility should develop programs that inspire and change the attitudes of health workers toward solid waste segregation.

Keywords: Solid waste, Health care waste management, Waste segregation, challenges of compliance to waste management, attitudes of health workers.

.Introduction

Waste segregation is the foundation of waste management in all health facilities and should take place at all patient care activity areas, diagnostic services areas, dressing rooms, and treatment rooms. According to Hanumantha (2008), segregation should begin with those who are responsible for waste generation, such as doctors, nurses, and paramedical personnel.

Chartier (2014) reported that effective waste segregation is significant in raising efficiency in hospital functions. It was also reported that globally, the World Health Organization (WHO) estimates that 75–90% of the waste from hospitals is not hazardous while 10 – 25% is hazardous (Chartier, 2014). Hazardous waste, if not properly segregated and managed, may get into water systems and cause major infections and disease in communities (WHO, 2004). Many developing countries have poor waste segregation systems and are reported to be taking this issue seriously in order to effectively manage health care waste (HCWs) (Gitonga, 2017). The WHO (2016) reported that in these countries there was improper and poor management of waste between 18% to 64%. This too was reported in Egypt including inadequate health care waste management (HCWM) (El-Salam, 2010).

African countries are struggling with HCW segregation, and many hospitals are having trouble managing waste in their facilities (Yazie, Tebeje & Chufa, 2019). Furthermore, safe waste segregation has received little attention, and many facilities do not satisfy the minimum

requirements for proper waste segregation. According to previous research, the proportion of HCW generation in most African countries is significantly higher than the WHO threshold (Tesfahun, *et al*., 2014). This threshold is 80% general waste segregation, 15% pathological and infectious waste, 1% sharps waste, 3% chemical or pharmaceutical waste, and special waste, such as radioactive or cytostatic waste, pressurized containers, broken thermometers, and used batteries, should account for less than 1% of total waste (WHO, 2017).

In Somalia, infectious health waste accounted for 53.73 % of waste (Bella *et al,* 2014). Infectious wastes were reported to be in about 44% of hospitals in Somalia (Abdikadir *et al.*, 2018). These figures are about 4 times higher than the WHO's advised threshold value (Chartier, 2014). Some of the reasons for the disparities could be due to a lack of segregation of hospital waste streams (Linzner & Ali, 2013). Poor waste segregation in hospitals results in higher disposal costs and offers a variety of environmental and public health risks (Mesfin *et al.,* 2014). However, the factors that have contributed to the continued inappropriate segregation of HCWs in Mogadishu hospitals remain unknown, leaving policymakers with insufficient information to make wise decisions. This study examined the factors associated with compliance to solid waste segregation among health care workers in this hospital.

Objective

The general objective of this study was to assess the factors associated with compliance to solid HCW segregation among the workers in this hospital, these objectives included:

- To establish the level of compliance to solid waste segregation among healthcare workers in Martini hospital, Somalia;
- To assess individual and health systems factors associated with compliance to solid waste segregation among healthcare workers.
- To investigate the association between the individual and health facility factors; and compliance to solid waste segregation among healthcare workers.

The study was conducted in Martini Hospital located in Mogadishu, Somalia. This hospital was chosen because it is one of the biggest hospitals in Mogadishu and has recorded poor waste segregation (Manya *et al.,* 2017).

Literature Review

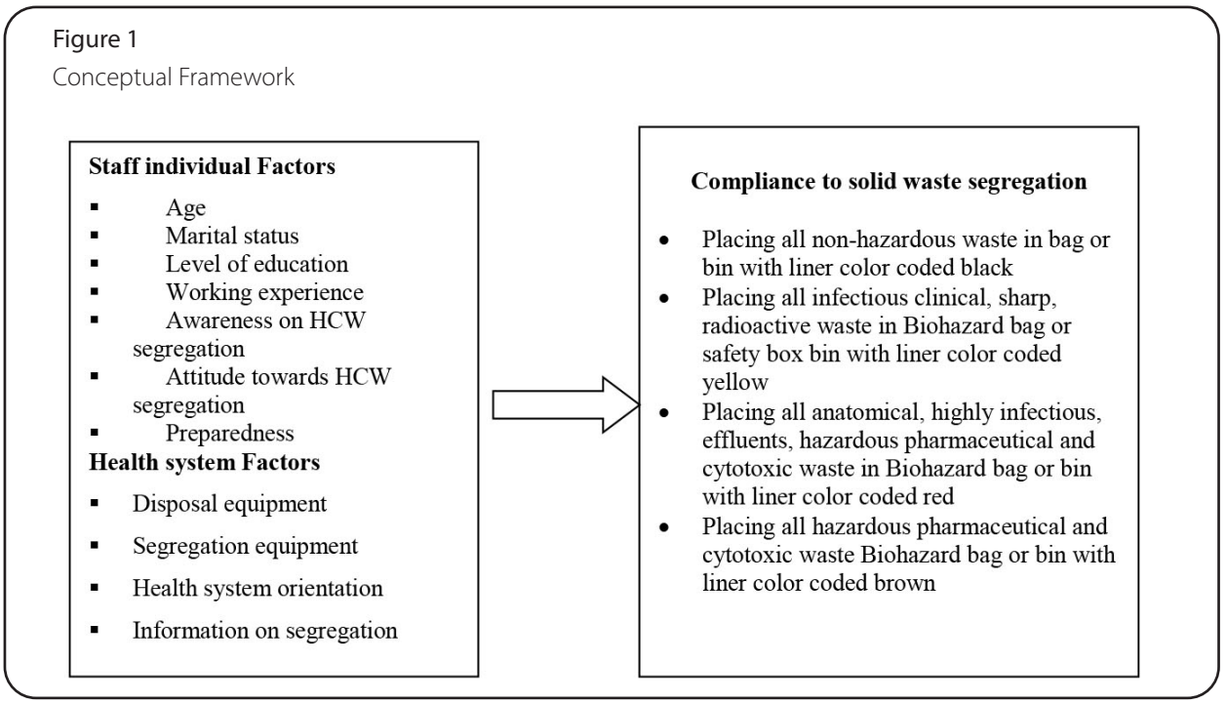
Multiple personal factors were identified to effect compliance to solid waste segregation in health facilities, these factors include age, marital status, education, working experience, awareness of HCW segregation, attitude, and preparedness toward HCW segregation (Dafaalla *et al*., 2016; Kayode and Omole, 2011; Lakbala & Lakbala, 2013; Manyele & Lyasenga, 2016; Maskey, Maharjan & Singh, 2016; Sarker, 2014;).In addition, the health system factors identified included disposal equipment, segregation equipment, health system orientation, and information on segregation (Hanumantha, 2008; Hossain, 2013; Kumari *et al*., 2018; Kumar *et al*., 2010; Moh and Latifah, 2014; Muhwezi *et al*., 2014).

The association between these factors and compliance, though reported by several researchers, is very limited to specific areas and target populations. However, some of the knowledge and contextual gaps identified in the research indicated above needed to be addressed. This study examined how the personal and health system factors are associated with compliance to solid waste segregation among health care workers in Martini Hospital.

Conceptual Framework

The conceptual framework shows the connection between individual and health system factors associated with compliance to solid waste segregation.

Figure 1
Conceptual Framework



Methodology

Research Design

This study adopted a facility-based cross-sectional survey design with a quantitative approach. The quantitative research approach was used to generate quantifiable data to investigate the factors associated with HCW generation.

Sampling

The study population was 154 permanent health care workers of this Hospital (Martini Hospital Annual Report, 2020). The sample size was 111 health care workers calculated using the Yamane Taro (1967) sample size calculation formula. The members of the sample size were identified by simple random sampling.

Data Collection Method and Instruments

Data was collected using researcher-administered questionnaires to the randomly picked 111 respondents. The questionnaire was pretested and checked for quality before being used in data collection following guidelines set up by the ethics committee. The filled-in forms were checked for quality before data analysis.

Ethical considerations

This study was approved by the Mulago Hospital Research Ethics Committee, Kampala, Uganda, and the researchers also got an acceptance and approval letter from the head of the hospital of study. There were no formal Research Ethics Committees in Somalia at the time of data collection.

All the relevant data collection ethics including confidentiality of the information, treating all study populations with dignity and respect, and ensuring their anonymity by using numerical codes for identification were used. The participants were informed that taking part in this study was of their own free choice and that any attempts to opt out of this exercise would not have any consequences. The relevant consent forms in the local language were used in this study.

The standard operating procedures for minimizing the risks of COVID 19 infections including the use of personal protective equipment and processes were strictly adhered to.

Data Analysis

Data collected was exported to SPSS version 20. Univariate analysis was used to address objectives 1 and 2 while objective 3 was analyzed using inferential statistics at bivariate and multivariate levels.

Results

The results are presented according to the objectives. ***Individual factors and compliance to solid waste segregation of the Health Care Workers in Martini Hospital***. The results in Table 1 below show the assessment of individual factors of health workers associated with compliance to solid waste segregation among healthcare workers in Martini Hospital:

Table 1
Individual Factors of the Health Care Workers

Individual characteristics		Frequency (N=110)	Percentage (%)
Age in full years	20-29	33	30.0
	30-39	25	22.7
	40-49	26	23.6
	50+	26	23.6
Marital status	Single	18	16.4
	Married	47	42.7
	Divorced	27	24.5
	Widowed	18	16.4
Highest level of formal educational	No formal education	35	31.8
	Primary	17	15.5
	Secondary	47	42.7
	Post-secondary	11	10.0
Working experience	Below 5 years	62	56.4
	5-10 years	48	43.6
Awareness	Low	61	55.5
	High	49	44.5
Attitude	Positive attitude	71	64.5
	Negative attitude	39	35.5
Preparedness	Yes	65	59.1
	No	45	40.9

The results show that most (52.7%) of the health workers were youth in the age bracket 20 and 39 years old, were married (42.7%) and most (56.4%) had spent less than 5 years working in this hospital.

Furthermore, 52.7% of the health workers had attained secondary level education and above and hence were literate enough to understand the issue that was being investigated. However, while many of the workers (55.5%) were not aware of the solid waste segregation practices and many (53.6%) reported being non-compliant, a higher percentage (64.5%) reported having a positive attitude toward solid waste segregation. Health Systems Factors and Compliance to Solid Waste Segregation among Healthcare Workers in Martini Hospital

Table 2 below shows the results of the health systems factors associated with compliance to solid waste segregation among healthcare workers in Martini Hospital.

Table 2
Health Systems Factors Associated with Compliance to Solid Waste Segregation among Healthcare Workers

Health systems factors		Frequency (N=110)	Percentage (%)
Disposal equipment	Yes	65	59.1
	No	45	40.9
Segregation equipment	Yes	47	42.7
	No	63	57.3
Health system orientation	Yes	70	63.6
	No	40	36.4
Information on segregation	Yes	78	70.9
	No	32	29.1

The majority (59.1%) of the respondents reported that solid waste disposal equipment is available at the hospital, but a close percentage (57.3%) reported the absence of the segregation equipment. The majority (63.6%) reported having received solid waste segregation orientation and many more (70.9%) reported the presence of information on segregation. These results agree with similar studies undertaken in Eastern Africa subregion (Babirye J. *et al* 2020; Devi A, *et al* 2019; and Sahiledengle, B, 2019). ***Association between Factors (Individual and Health Systems) and Compliance to Solid Waste Segregation among Healthcare Workers in Martini Hospital.***

To determine the association between the factors and compliance to waste segregation, the data were subjected to Pearson Chi-square analysis at the bivariate analysis level followed by multivariate level and binary logistic regression was fitted. The inferential results are tabulated in Tables 3, 4 and 5 below. Table 3 shows the Chi-Square results for the association between individual factors and compliance to solid waste segregation.

Table 3
Chi-Square Results for Association between Individual Factors and Compliance to Solid Waste Segregation among Healthcare Workers in Martini Hospital

		Compliance			
		Yes	No		
Associated Factors		**N (%)**	**N (%)**	**χ^2**	***p*-Value**
Individual Factors					
Age In Years	20-29	19(57.6)	14(42.4)	2.729	.442
	30-39	10(40.0)	15(60.0)		
	40-49	10(38.5)	16(61.5)		
	50+	12(46.2)	14(53.8)		
Marital status	Single	7(38.9)	11(61.1)	8.030	**.046****
	Married	26(55.3)	21(44.7)		
	Divorced	7(25.9)	20(74.1)		
	Widowed	11(61.1)	7(38.9)		
Highest level of formal educational	No formal education	12(34.3)	23(65.7)	5.509	.142
	Primary	6(35.3)	11(64.7)		
	Secondary	27(57.4)	20(42.6)		
	Post-secondary	6(54.5)	5(45.5)		
Experience	Below 5	31(50.0)	31(50.0)	.756	.443
	5-10	20(41.7)	28(58.3)		
Awareness	Low	37(60.7)	24(39.3)	11.248	**.001****
	High	14(28.6)	35(71.4)		
Attitude	Positive	39 54.9	32(45.1)	5.909	**.012****
	Negative	12(30.8)	27(69.2)		
Preparedness	Yes	34(52.3)	31(47.7)	2.257	.133
	No	17(37.8)	28(62.2)		

***Significant at 5% level*

In relation to individual-related factors, the results in Table 3 indicate that marital status ($\chi^2 = 8.030$, $p < 0.05$); awareness of solid wastes segregation ($\chi^2 = 11.248$, $p < 0.05$); and attitude towards solid waste segregation ($\chi^2 = 3.227$, $p < 0.05$), were significantly associated with compliance to solid waste segregation in this Hospital. The rest of the other factors were not significant. Table 4 below shows the Chi-Square results for the association between health systems factors and compliance to solid waste segregation among health workers.

Table 4
Chi-Square Results for Association between Health System Factors and Compliance to Solid Waste Segregation among Healthcare Workers in Martini Hospital

		Compliance			
		Yes N (%)	No N (%)	χ^2	*p*-Value
Health System Factors					
Disposal equipment	Yes	34(52.3)	31(47.7)	2.257	.174
	No	17(37.8)	28(62.2)		
Segregation equipment	Yes	20(42.6)	27(57.4)	.479	.309
	No	31(49.2)	32(50.8)		
Health system orientation	Yes	28(40.0)	42(60.0)	3.135	**.058**
	No	23(57.5)	17(42.5)		
Information on segregation	Yes	44(53.0)	39(47.0)	6.010	**.012****
	No	7(25.9)	20(74.1)		

***Significant at 5% level*

The results in Table 4 above indicate that only information on segregation ($\chi^2 = 6.010$, $p < 0.05$) and health system orientation ($\chi^2 = 3.135$, $p < 0.05$) were significantly associated with compliance to solid waste segregation. The rest of the other factors were found not to be significant. To confirm the association between the factors (individual and health systems) with compliance to solid waste segregation among healthcare workers, the factors that were significant at 5 at bivariate analysis were subjected to binary logistic regression at the multivariate level of analysis and this is presented in Table 5 below.

Table 5
Multivariate Binary Logistic Regression Results for the Association between Factors (Individual and Health Systems) and Compliance to Solid Waste Segregation among Healthcare Workers at Martini Hospital

		Compliance			
		Yes	No		
Associated Factors		N (%)	N (%)	COR (95%CI)	*AOR (95%CI)*
Individual Factors					
Marital status					
	Single	7(38.9)	11(61.1)	.34(.071-1.61)	0.31(.07-1.51)
	Married	26(55.3)	21(44.7)	.14(.03-.61)	0.38(.036-4.03)
	Divorced	7(25.9)	20(74.1)	.53(.15-1.86)	0.56(.16-1.96)
	Widowed	11(61.1)	7(38.9)	1	1
Awareness					
	Low	37(60.7)	24(39.3)	3.09(1.27-7.52)	**3.29(1.36-7.97)**
	High	14(28.6)	35(71.4)	1	**1**
Attitude					
	Positive	39 54.9	32(45.1)	3.10(1.15-8.37)	**3.39(1.26-9.19)**
	Negative	12(30.8)	27(69.2)	1	1
Health Systems Factors					
Health system orientation					
	Yes	28(40.0)	42(60.0)	.37(.14-.97)	**0.35(.14-.91)**
	No	23(57.5)	17(42.5)	1	1
Information on segregation					
	Yes	44(53.0)	39(47.0)	2.98(1.22-7.26)	2.76(.37-20.46)
	No	7(25.9)	20(74.1)	1	1

***Significant at 5% level*

Marital Status: Though significant at the bivariate level, marital status was not significant after being considered in the multivariate analysis (AOR = 0.38; 95%CI: 0.036-4.03). The findings indicate that compliance to solid waste segregation was only 0.38 times more likely to be higher than those in other marital statuses.

Awareness of Solid Waste Segregation:The multivariate analysis (AOR = 3.29; 95%CI:1.36-7.97) indicates a strong association between awareness and compliance, and that health workers with high levels of awareness were 3.29 times more likely to comply with the recommended solid waste segregation practices compared to those with low awareness.

Attitude towards Solid Waste Segregation: The results show a significant relationship with compliance to solid waste segregation among healthcare workers after being considered in the multivariate analysis (AOR = 3.39; 95%CI:1.26-9.19). This further indicates that attitudes towards solid waste segregation were 3.39 times more likely to comply with the recommended solid waste segregation practices compared to those with a negative attitude.

Health System Orientation: The results (Table 5 above) indicate that Health system orientation (AOR = 0.35; 95%CI:0.14-.91) was significantly associated with compliance to solid waste segregation after being subjected to multivariate analysis. The results indicate that compliance to solid waste segregation was 0.35 times more likely among oriented health workers than those not orientated.

Information on segregation: This factor was found not to be significant at the multivariate level (AOR = 2.76; 95%CI:0.37-20.46). Thus, information on segregation is not an important predictor of compliance to solid waste segregation among healthcare workers.

Discussion

The Personal Factors and Compliance to Solid Waste Management

The results indicate a relatively youthful health workforce in this hospital. This implies that data was collected from a group of health workers who are actively engaged in the hospital activities including solid waste segregation. The results are comparable to the findings in a study by Soukopová, Struk, & Hřebíček (2016) who reported the lowest level of solid waste generation was among children and teenagers, and the highest was among much older persons.

Results further show that most of the workers are married with family responsibilities which implies that they do appreciate the challenges of managing solid waste at least in a domestic environment. Education results are comparable to findings in a study by Sarker (2014) who reported that most health workers had attained secondary education. The length of stay at the hospital results are comparable to the study done by Maina *et al*. (2016) who revealed that experience among the staff did not matter in the knowledge of HCWM and that those who had worked for 1 – 5 years were more committed.

The study showed that most health workers (55.5%) are not aware of solid waste segregation. This result is similar to findings in a study by Woldu *et al.* (2016) who reported that the majority of health workers are not aware of the solid waste segregation practices. Despite the low awareness among most of the health workers, most (64.5%) of them reported a positive attitude towards solid waste segregation. This finding is similar to that of Malini & Eshwar (2015) who reported that a lack of awareness and knowledge among the staff about hospital waste management leads to poor management and has negative consequences on human health. The results also show high levels of non-compliance to solid waste segregation which results in negative effects on health standards. This result is similar to one reported by Linzner & Ali (2013) who indicated that there is a high possibility of poor solid waste segregation in hospitals due to non-compliance and fear of the additional costs related to disposal.

Health System Factors and Compliance

For a safer and cleaner hospital environment, the high availability of solid waste disposal equipment is very crucial. The study findings however indicated the non-availability of solid waste disposal equipment at the hospital and this is indicative of a failed solid waste segregation system which is very undesirable.

However, the results also show that there is a high level of health system orientation among the health workers. Similarly, the results showed high availability of information on solid waste segregation in this hospital. These results are in agreement with observations by several previous researchers (Babirye J, *et al* 2020; Devi A. *et al* 2019; Gayathri *et al* 2005; Sahiledengle, B 2019).

Association between Factors (Individual and Health Systems) and Compliance to Solid Waste Segregation among Healthcare Workers

The results indicate that awareness of solid waste segregation, attitude towards solid waste segregation, and health system orientation were found to be very significant in compliance and this agrees with several researchers (Kumari *et al*., 2010; Lakbala *et al.,* 2013; Manyele *et al.,* 2016; Omole *et al.,* 2018; and Yong *et al*. 2009).

Conclusion

The study concludes that poor compliance is a high burden on solid waste segregation practices in Martini hospital and if no appropriate interventions are put in place could be detrimental to the health of the workers and the community. The results show some factors which if encouraged would enhance the compliance to solid waste segregation and eventually improve solid waste management. It is also clear that awareness, attitude, and health system orientation are critical in improving compliance to solid waste segregation among health workers in this hospital. It is recommended from the above results that there is need to improve awareness to compliance in waste segregation among health care workers

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Acknowledgements

The authors wish to thank Bugema University School of Graduate Studies for the support given in the research and write-up of this paper. They also wish to thank Martini General Hospital in Somalia for allowing data to be collected from the Hospital. Lastly, the authors wish to highly appreciate Bugema University for its financial support in the publication of this paper.